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EXERCISES.

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Prove the formula

$$x = \int_0^x \cos z \, . \, J_0 \left(\sqrt{z^2 - x^2}\right) dz,$$

in which J_0 denotes the ordinary Bessel's function of the zero order.

[*Maxime Bôcher.*]

336

If Sylvester's difference-product determinant $\zeta^{\frac{1}{2}}(1, 2^2, 3^2, \ldots, n^2) = \Delta$, and if we represent this determinant when the rth column and pth row are deleted by $\Delta(r, p)$; evaluate the ratio $\Delta(r, p)/\Delta$ when n is infinite.

[*W. H. Echols.*]

337

Required the locus of the foot of the perpendicular from the centre of an ellipse upon the common chord of the ellipse and circle of curvature.

[*Artemas Martin.*]

338

Prove synthetically that the eccentricity of a conic section is equal to the sine of the angle which the cutting plane makes with the base of the cone, divided by the sine of the angle which an element of the cone makes with the base. [*H. B. Newson.*]

339

Show that the areas of the curves

$$y = px^2 + qx + r, \text{ and } y = mx^3 + px^2 + qx + r,$$

taken between the limits $x + h$ and $x - h$, are given by the formulæ

$$\Omega = 2yh + \tfrac{2}{3}ph^3, \text{ and } \Omega = 2yh + (\tfrac{2}{3}p + mx)h^3,$$

respectively. [*W. H. Echols.*]

340

Find the differential equation of plane curves of the third degree free from the constants of the general integral equation. [*Yale Prize Problem.*]

341

Required the form of a beam of uniform strength, supported at its ends, the weight of the beam being the only load. [*De Volson Wood.*]